Report for 2002MN2B: Effects of riparian forest harvest on instream habitat and fish and invertebrate communities

There are no reported publications resulting from this project.

Report Follows:

Effects of riparian forest harvest on instream habitat and fish and invertebrate communities

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Funding Source: USGS-WRRI 104B National Grants Competition
Project Duration: March 1, 2002 through February 28, 2003

Summary

Stream riparian zones are critical to the health of stream fish and invertebrate communities. Forest harvest within the riparian zone may thus impact stream fish and invertebrate communities and the determination of the level of acceptable harvest within the riparian zone is important to balance forestry needs with stream biotic integrity. We have designed a manipulative experiment to determine the effects of no, low and high levels of riparian harvest on stream habitat and fish and invertebrate communities. Sites have been selected, treatments have been planned and pre-harvest sampling will be initiated in summer 2003.

Introduction

Forest products are an important natural resource in the upper Midwest. In Minnesota, timber harvest has been increasing and will continue to increase in the near future (Anonymous 2001). Timber harvest activities have the potential to degrade water quality and aquatic resources and for this reason, best management practices (BMPs) or site-level forest management guidelines have been adopted to protect riparian and aquatic resources in Minnesota (MFRC 1999, Anonymous 2001). Although these best management practices are based on the best available scientific information, and implementation monitoring is being conducted (Anonymous 2001), they have not been evaluated for effectiveness at protecting aquatic resources. Most research on the effects of forest harvest on streams and the effectiveness of forest harvest BMPs has been conducted in more mountainous regions such as Tasmania (Davies and Nelson 1994), the Sierra Nevada's, the Pacific Northwest and the Appalachian East (e.g., Meehan 1991, Castelle and Johnson 2000). These results may not be directly applicable to the midwest (Perry et al. 1992).

Riparian zones provide many protective services to streams (Gregory et al. 1991, Castelle et al. 1994, Castelle and Johnson 2000). Determination of the necessary width of riparian buffers (e.g., Castelle and Johnson 2000) or the permissible level of harvest within a buffer is essential to adequately protect stream resources without removing a large portion of the basin from harvest. Most studies on the effectiveness of riparian buffers at protecting streams from upslope harvest have focused on the width of the buffer and have not considered harvest with the buffer zone (e.g., Barton et al. 1985, Castelle and Johnson 2000). Current Minnesota best management practices allow varying degrees of harvest within the riparian management zone (RMZ). Harvest within the zone may be used to promote regeneration of shade intolerant species and thus it is important to know what level of harvest within the zone reduces its effectiveness at maintaining stream quality.

The objective of this project is to experimentally determine the effectiveness of various levels of riparian harvest at protecting in-stream resources. We will examine site-based effects associated with high, low and no riparian harvest (30m Riparian Management Zone, upland clearcuts) on aquatic habitat, macroinvertebrates and fish. Specifically, we will evaluate effects on fish and invertebrate habitat (temperature, sediment composition and embeddedness, depth, width, cover, bank stability, canopy coverage, woody debris, etc.), benthic macroinvertebrates and stream fish communities.

Methodology

During 2002 we focused on site selection; good site selection is critical to the long-term success of this project. A full time US Forest Service employee and a retired DNR Forester were hired (with the LCMR matching funds) to make contacts and locate appropriate sites. Over 350 contacts were made with State, county, federal, Tribal, and private industry groups to introduce the project, solicit assistance, and to visit field sites.

By June 2002 it became apparent that we would not have enough sites to initiate sampling and it was also apparent that we would not find enough quality sites within the criteria of the initial design (4 replicate sites within each of 5 watersheds). After visits to 60 potential sites the investigators on the LCMR project decided to change the experimental design and criteria so we could find adequate sites while maintaining good control and site similarity. These design changes were approved by LCMR and resulted in 3 (control, low and high riparian harvest) rather than 4 treatments, and replication by treatment pairs rather than watersheds. Beaver activity and low riparian canopy densities limited our ability to find replicate sites within watersheds for four harvest treatments. Thus we established treatment sites within 8 pairs of stands in northern Minnesota. Within each pair we will establish a riparian control (upland clearcut) and one riparian management treatment to compare the effects of different residual basal area levels. Where possible we will also include a non-harvested control (both upland and riparian zone not harvested). We also dropped the need for harvest on both sides of the stream but increased the amount of stream length exposed to harvest (to 200m).

Results and on-going work

Based on the new design and examination of over 100 sites, eight pairs of treatment sites (riparian control and one harvest treatment) have been located, timber sales secured, and harvest plots have been marked. Sites are located in Beltrami, Carlton, Cook, Lake, and St. Louis counties. Pre-harvest sampling will be conducted in summer 2003 and the treatment sites will be harvested in winter 2003-2004. Post-harvest data will be collected in summer 2004.

We have accepted and hired two new graduate students who are well suited to the project; an additional PhD candidate with considerable experience on a related project will assist with setup and sampling during summer 2003. Funding for additional years of post-harvest assessment will be pursued from a variety of sources.

Literature cited

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Perry, J., K. Brooks, W. Olsen, T. Geier, W. Johnson, R. Newman, L. Mizner and N. Troelstrup. 1992. Water quality and fisheries: a technical paper for a Generic Environmental Impact Statement on Timber Harvesting and Forest Management in Minnesota. Report to the Minnesota Environmental Quality Board by Jaakko Pöyry Consulting. 325 pgs.

Publications associated with the project
None

Students supported by the project
Starting in June 2003:
Dickson Atuke (PhD), Fisheries and Aquatic Biology Track in Conservation Biology
Nick Schlesser (MS), Fisheries and Aquatic Biology Track in Conservation Biology – additional support from fellowships and LCMR Grant
Nat Hemstad (PhD), Water Resources Science – 3 month field assistant supported on LCMR Grant

Awards and achievements resulting from your project
None

Seminar or poster presentations resulting from your project
None

Related grants submitted or funded as a result of this project
The Legislative Commission on Minnesota Resources is funding the manipulation, travel, supplies and field assistance

The Minnesota Forest Resources Council provided funds for some supplies and assistance
A proposal for longer-term continuation of this project has been requested by the Minnesota Department of Natural Resources and will be submitted in August 2003.